Intracranial Aneurysms Associated with a Double Origin of the Posterior Inferior Cerebellar Artery

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Summary

The posterior inferior cerebellar artery (PICA) frequently has a variable course and target territory. However, double origin PICA is a rare finding. Its significance is uncertain, but it has been associated with intracranial aneurysms localized at the PICA proper or at a distant site. The presence of this variation imposes specific challenges.

We describe two cases of double origin PICA, one of them associated with an ipsilateral PICA aneurysm. The role of this finding was critically reviewed. A literature search identified 23 cases of double origin PICA, including both cases reported in this paper. Intracranial aneurysms were strongly associated with double origin PICA (71% in 21 detailed cases of double origin PICA). The current patient harboring a PICA aneurysm was successfully treated by endovascular trapping.

In the setting of double origin PICA aneurysms, this variation beneficially affects the treatment choice once the two limbs enable the safe sacrifice of the channel involved, with preservation of blood flow through the other channel.

Introduction

Developmental anomalies of intracranial arteries are not infrequently encountered during angiography [1,2]. Although the posterior inferior cerebellar artery (PICA) commonly has a variable course, caliber, length, and target territory, fenestrations and double origins are exceedingly rare [1-12].

A PICA with a double origin manifests itself as two separate vessels arising from the same vertebral artery that then converge and form the PICA proper [1-12]. The knowledge of such variations exceeds the simple anatomical description to become important information in clinical practice, once it may beneficially or detrimentally affect the prognosis of intracranial vascular diseases.

Double origin of the PICA (DOPICA) can be associated with intracranial aneurysm formation at the PICA proper or at a distant site [1-12]. It can impose specific challenges for treatment in the setting of subarachnoid hemorrhage. Our literature search yielded only four cases of aneurysms localized in a PICA with double origin [2,3,6].

We describe two cases of double origin of PICA, one of them associated with an ipsilateral PICA aneurysm. This finding is analyzed regarding the role of this variation in aneurysm formation and treatment particularities.

Case Reports

Case 1

A 53-year-old man presented to the emergency department with a history of throbbing headache and seizures. The CT scan demon-

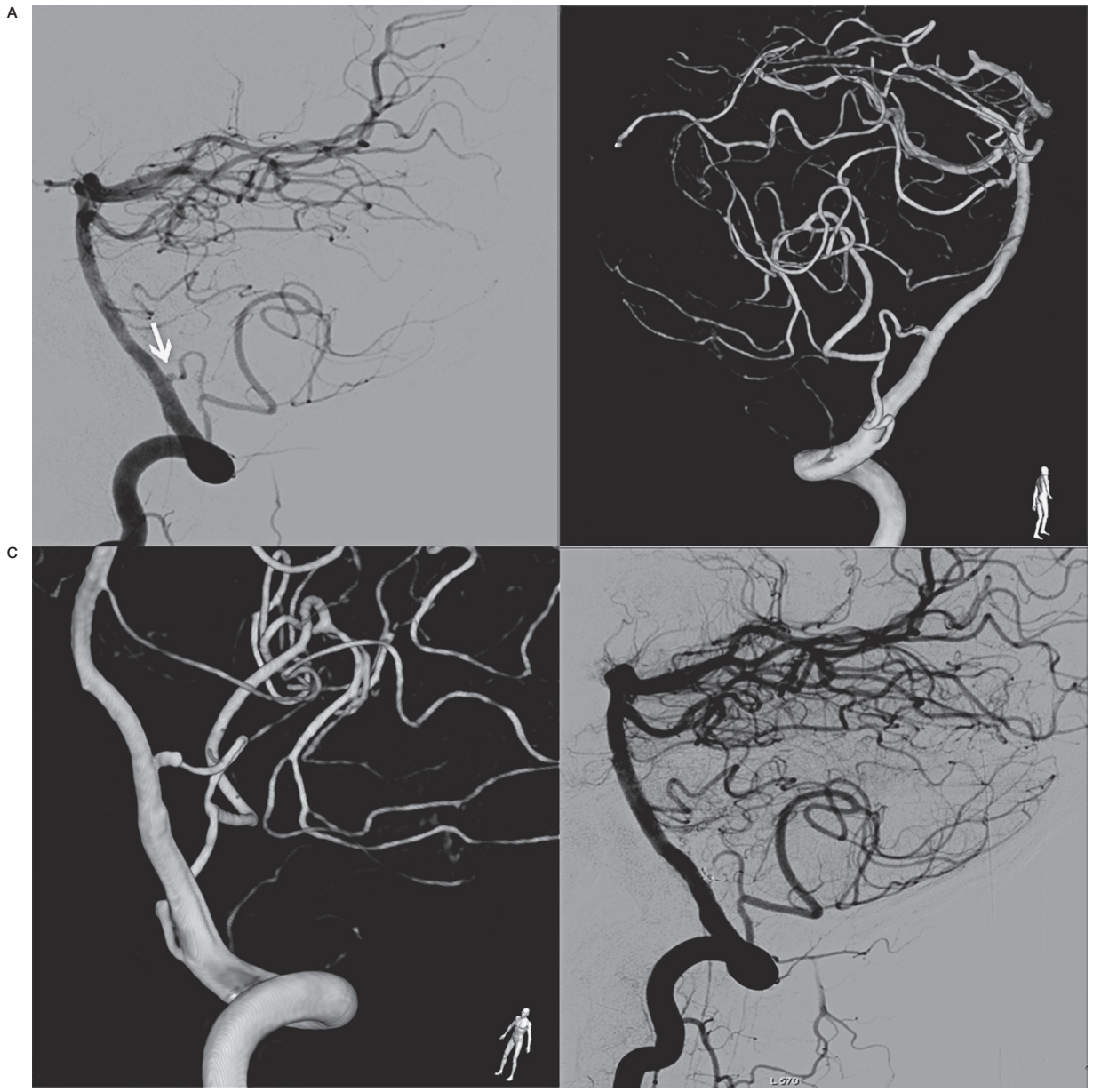

Figure 1 A) Lateral left vertebral artery angiography shows a DOPICA with an aneurysm in the cranial channel (white arrow). B,C) 3D reconstructions demonstrate the site of convergence of DOPICA and the aneurysm evolving the cranial channel. D) Post treatment angiography shows internal trapping of the aneurysm and the filling of distal PICA through the caudal channel.

strated a blood clot in the left cerebellomedullary cistern. A DSA showed a very small dissecting aneurysm localized in the anterior medullary segment of the cranial channel of a left PICA with double origin. The caudal origin was localized in the V3 segment of vertebral artery and the cranial origin in the V4 segment. Both channels converged at the tonsillomedullary segment of the PICA (Figure 1A-C).

Endovascular treatment was chosen. We performed direct catheterization of the V4 PICA origin and internal trapping using coils. Once we feared intraprocedural perforation of the aneurysm, a balloon was positioned in the left vertebral artery and insufflated during coiling. It also prevented coil prolapse into the vertebral artery.

Total occlusion of the aneurysm was achieved and PICA filling was observed through the caudal channel (Figure 1D).

The patient had an uneventful recovery and was discharged neurologically intact.

Table 1 **Patients with double origin of the posterior inferior cerebellar artery (PICA).**

No.	Author (year)	Age, Sex	Presentation	Side	Caudal channel origin	Cranial channel origin	Site of convergence	Concurrent aneurysm	Associated variations	PICA aneurysm treatment	Result	Complication
1	Stopford[8] (1916)	NM	Anatomical study	Rt	V4	V4	Lateral medullary	NM	NM	–	–	–
2	Lasjaunias[9] (1985)	NM	NM	Lt	V3	V3	Lateral medullary	NM	NM	–	–	–
3	Pasco[2] (2002)	36, M	SAH	Lt	V3	V4	Tonsillo-medullary	Lt PICA cranial channel	–	Trapping (glue)	Anatomical exclusion	Medullary infarction
4		50, M	Incidental	Lt	V4	V4	Tonsillo-medullary	–	–	–	–	–
5	Lesley[1] (2004)	66, M	Incidental	Rt	V4	V4	Anterior medullary	–	–	–		
6	Kwon[6] (2007)	NM	NM	Lt	V3	V4	Lateral medullary	NM	NM	–	–	–
7		68, F	SAH	Rt	V3	V4	Anterior medullary	Rt PICA caudal channel	NM	Trapping (coil)	Anatomical exclusion	None
8		50, F	SAH	Lt	V3	V4	Lateral medullary	Lt vertebral	NM	–	–	–
9		NM	NM	Rt	V3	V4	Lateral medullary	NM	NM	–	–	–
10		72, M	SAH	Lt	V3	V4	Anterior medullary	Lt vertebral	NM	–	–	–
11		NM	NM	Lt	V3	V4	Lateral medullary	NM	NM	–	–	–
12		NM	NM	Rt	V3	V4	Anterior medullary	NM	NM	–	–	–
13		NM	NM	Rt	V3	V4	Tonsillo-medullary	NM	NM	–	–	–
14	Lesley[5] (2007)	67, F	Incidental	Lt	V3	V4	Anterior medullary	Lt trigeminal artery	Fenestrated VBJ, trigeminal artery	–	–	–
15		42, F	SAH	Lt	V3	V4	Anterior medullary	Basilar tip	–	–	–	–
16		82, M	Incidental	Rt	V3	V4	Anterior medullary	Superior hypophyseal	–	–	–	–
17	Vora[3] (2008)	57, M	SAH	Rt	V4	V4	NM	Rt PICA caudal channel	–	Trapping + stent	Anatomical exclusion	None
18	Lee[7] (2009)	43, M	Incidental	Lt	V3	V4	Lateral medullary	Rt vertebral	Anomalous ACA, duplicated SCAs, PICA fenestration	–	–	–
19	Plumb[4] (2009)	49, F	SAH	Rt	V3	V4	Anterior medullary	Lt PICA	–	–	–	–
20	Cho[11] (2010)	72, M	Incidental	Lt	V3	V4	Lateral medullary	Rt MCA	Fenestration of caudal origin	–	–	–
21	Fan[12] (2011)	58, M	SAH	Lt	V3	V4	Anterior medullary	Lt vertebral	–	–	–	–
22	Current study	53, M	SAH	Lt	V3	V4	Tonsillo-medullary	Lt PICA cranial channel	–	Trapping	Anatomical exclusion	None
23		44, M	SAH	Lt	V3	V4	Lateral medullary	–	–	–	–	–

Kwon (2007): all patients had intracranial posterior circulation aneurysms. One of the "NM" patients had PICA cranial channel aneurysm. Three patients had aneurysms involving PICA and vertebral artery simultaneously.

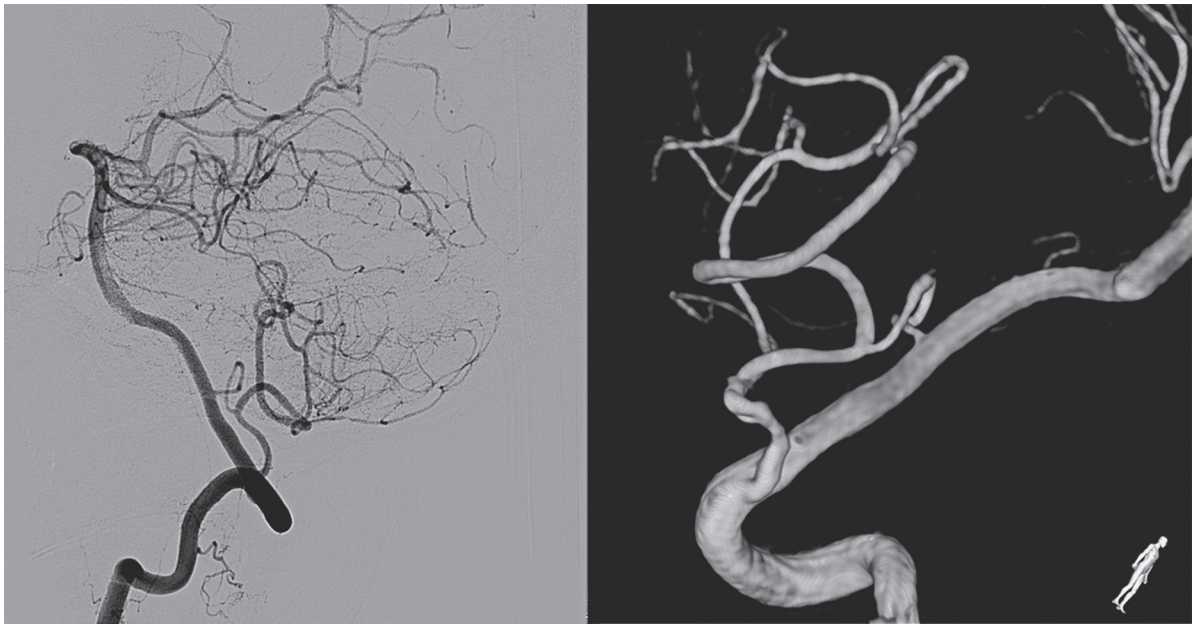

Figure 2 A) Lateral left vertebral angiogram demonstrates the DOPICA. B) 3D reconstruction.

Case 2

A 44-year-old man was admitted to the hospital with a history of sudden onset headache. The neurological examination was normal. A CT scan demonstrated subarachnoid blood in the perimesencephalic cistern. DSA showed no abnormalities, except for a left double origin PICA. The caudal origin was localized in the V3 segment of vertebral artery and the cranial one in the V4 segment. Both channels converged at the lateral medullary segment of PICA (Figure 2A,B). DSA and MRI performed after one month did not elucidate the origin of bleeding.

Discussion

Anatomical variations of the cerebral vasculature are common findings in angiography [1,2]. An important step in the technical development of cerebrovascular imaging was ultrahigh resolution 3D angiography, which more frequently allows the identification of such variations. The most recognizable oddities include the fenestrated, duplicated, and anomalous origins of arteries [1-12]. These variations correspond to a combination of spontaneous regression and persistence of specific arterial channels within the vascular network of the neural tube [9].

The PICA normal course is divided into five segments, the first three being the perimedullary segments. The level of its origin and course are very variable and well-described [10].

The prevalence of DOPICA on angiography remains unknown because only a few cases have been published [1-12]. Stopford [8] reported one (0.6%) case of DOPICA in a study on 150 human brains. Lesley [5] conducted a retrospective assessment of 207 patients who had undergone conventional angiography, and reported that 1.45% of their study sample had DOPICA. A literature search identified 23 cases of DOPICA, including both cases reported in this paper (Table 1) [1-12].

The double origin PICA represents an anastomosis between a persistent lateral spinal artery (caudal channel) and the proper intracranial PICA (cranial channel). The lateral spinal artery originates lateral to the medulla, from either the PICA or the intradural vertebral artery, and then courses caudally, parallel to the spinal component of the 11th nerve [9].

In 19 (82%) of the 23 reported cases of DOPICA, the caudal origin was localized in the V3 segment, while the cranial origin was in the V4 segment in 22 cases (95%). The site of convergence was at the anterior medullary, lateral medullary and tonsillomedullary segments in 39%, 39% and 22%, respectively (Table 1).

As double origin of PICA has rarely been reported, the significance of the finding is uncertain, but it has been associated with intracranial

aneurysms [1-12]. They were present in 15 (71%) of 21 detailed cases of DOPICA. The aneurysm involved one of the DOPICA's channels in five (23%) cases (Table 1). Moreover, there was a large prevalence of dissections and dissecting aneurysms of posterior circulation [6,7].

Intracranial dissections, once thought to be rare, are now increasingly recognized. Dissecting aneurysms represent 23% of vertebral artery aneurysms and 3.2% of all intracranial aneurysms. The natural history of such lesions presenting with subarachnoid hemorrhage is notable for a high incidence of recurrent bleeding (up to 30 to 70%) within the first hours or days after ictus [13-18].

While leading with saccular aneurysms, selective treatment is always desired. On the other hand, results of multiple series suggest surgical ligation or coil embolization to occlude directly the affected segment of artery as the appropriate therapy for dissecting aneurysms. This is generally clinically well tolerated [6,12-14,17,18].

However, if the lesion involves the PICA or the contralateral vertebral artery is hypoplasic, this treatment modality is controversial. Another problem is the perforating vessels that arise preferentially from the intracranial vertebral artery and the second and third PICA segments. Despite the rich anastomotic network of perforating vessels, nonselective treatment is risky [2,9,10]. Proximal occlusion or surgical bypass must be considered.

The treatment choice in four aneurysms involving the DOPICA proper was endovascular trapping, including the current case [2,3,6]. One patient presented a medullary infarction, probably due to perforating vessel occlusion at the tonsillomedullary segment [2]. We think trapping using coils is preferable to glue, as inadvertent distal occlusion can occur with the latter.

In the setting of DOPICA aneurysms, this variation beneficially affects the treatment choice, once the two limbs enable the safe sacrifice of the involved channel, with preservation of the blood flow through the other channel.

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